

## **RAIL VEHICLE, IN PARTICULAR LIGHTWEIGHT MOTOR CAR**

[0001] The present application hereby claims priority under 35 U.S.C. §119 on German patent application number DE 102 54 440.9 filed November 21, 2002, the entire contents of which are hereby incorporated herein by reference.

### **Field of the Invention**

[0002] The invention generally relates to a rail vehicle. In particular, it relates to a lightweight motor car, with a vehicle head which contains a driver's cab, and a car body with a passenger compartment.

### **Background of the Invention**

[0003] The requirements which are made of lightweight motor cars with respect to a collision (crash) with another railroad vehicle are defined, for example, in DIN 5560. According to this standard, the driver's cab and the passenger compartment must not be permanently deformed given a collision of the lightweight motor car with what is referred to as a reference collision body (a main-line railroad vehicle with a rigid mass of 80 tonnes or a lightweight motor car of the same type) up to a speed of 8 km/h. At higher collision speeds, deformations of the driver's cab which are permanent to a limited degree and deformations of the passenger compartment which are permanent to a minimal degree are tolerated as consequences. In known rail vehicles, these requirements can be met only by using conventional head structures which have a cage-like metal framework with sheet metal covering, integrated into the rest of the car body.

**SUMMARY OF THE INVENTION**

[0004] An embodiment of the invention is based on an object of designing a rail vehicle in such a way that the previously mentioned requirements relating to a collision can be fulfilled even when a vehicle head, which is manufactured in particular from plastic or even from metal, is used. Further, at the same time a high degree of flexibility may be achieved in terms of the design of the vehicle.

[0005] An object may be achieved according to an embodiment of the invention by virtue of the fact that the vehicle head is embodied as a self-supporting unit and shock absorbing elements which operate in a telescopic fashion and which absorb the energy which occurs during a collision are arranged underneath this vehicle head.

[0006] Advantages which can be achieved by an embodiment of the invention can include obtaining a short deformation travel accompanied by a uniform force profile and a controllable force profile over the travel. This can be done, for example, by using shock absorbing elements which operate in a telescopic fashion, wherein it is possible to integrate a reversible step and a nonreversible step. The vehicle which is equipped with the shock absorbing elements which operate in a telescopic fashion has a high degree of stability with respect to side forces because these shock absorbing elements can be subjected to higher stresses in the lateral direction than known box-shaped crushable elements within a vehicle structure.

[0007] An integrated, premounted and pretested vehicle head can also advantageously be used. The vehicle head can be of a flexible design. Thus, it is possible to

implement a driver outer door by using the shock absorbing elements which operate in a telescopic fashion and take up relatively little space.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0008] The present invention will become more fully understood from the detailed description of preferred embodiments given hereinbelow and the accompanying drawing, which is given by way of illustration only and thus are not limitative of the present invention, and wherein:

[0009] The drawing shows the head part of a rail vehicle in a side view.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0010] The rail vehicle has a vehicle head 3a which contains a driver's cab, and a car body 2. The car body is configured in particular for conveying passengers and has, as is customary, an underframe, side walls and a roof. The vehicle head 3a, which is associated with the supporting structure of the car body, is embodied as a self-supporting unit. The vehicle head 3a is equipped, as a mechanically premounted and electrically pretested assembly, with corresponding components, for example driver's seat 3c, driver's console. In addition, the vehicle head 3a can have a driver outer door 3b.

[0011] Shock absorbing elements 1a, 1b, which engage one in the other in a telescopic fashion and which are connected to the car body 2 approximately at the level of the underframe or buffer, are arranged underneath

this vehicle head 3a. It is recommended to cover the shock absorbing elements 1a, 1b using a front panel 4.

[0012] The shock absorbing elements may have a reversible step 1a and/or a nonreversible step 1b. In the exemplary embodiment, the reversible step 1a of the hydraulically operated shock absorbing element is configured in such a way that the energy occurring during the collision at up to 8 km/h which is described at the beginning is absorbed solely by way of this step 1a. As is apparent from the drawing, in this case no permanent deformations of the vehicle head 3a occur. At collision speeds above 8 km/h, the nonreversible second step 1b of the shock absorbing element is stressed. Although a permanent deformation of the vehicle head 3a occurs here, a sufficiently large survival space for the driver remains.

[0013] A collision with other rail vehicles therefore acts directly on the shock absorbing elements 1a, 1b, and the vehicle head 3a is involved only to a slight degree. In order to prevent the vehicle head 3a having to absorb the energy alone if there is a collision between the vehicle and higher bodies, either the impact surface of the shock absorbing elements 1a, 1b can be increased in the upward direction or a mechanical connection for force to be applied by the head structure to the shock absorbing elements 1a, 1b can be provided between the structure of the vehicle head 3a and the shock absorbing elements 1a, 1b.

[0014] Exemplary embodiments being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be

obvious to one skilled in the art are intended to be included within the scope of the following claims.